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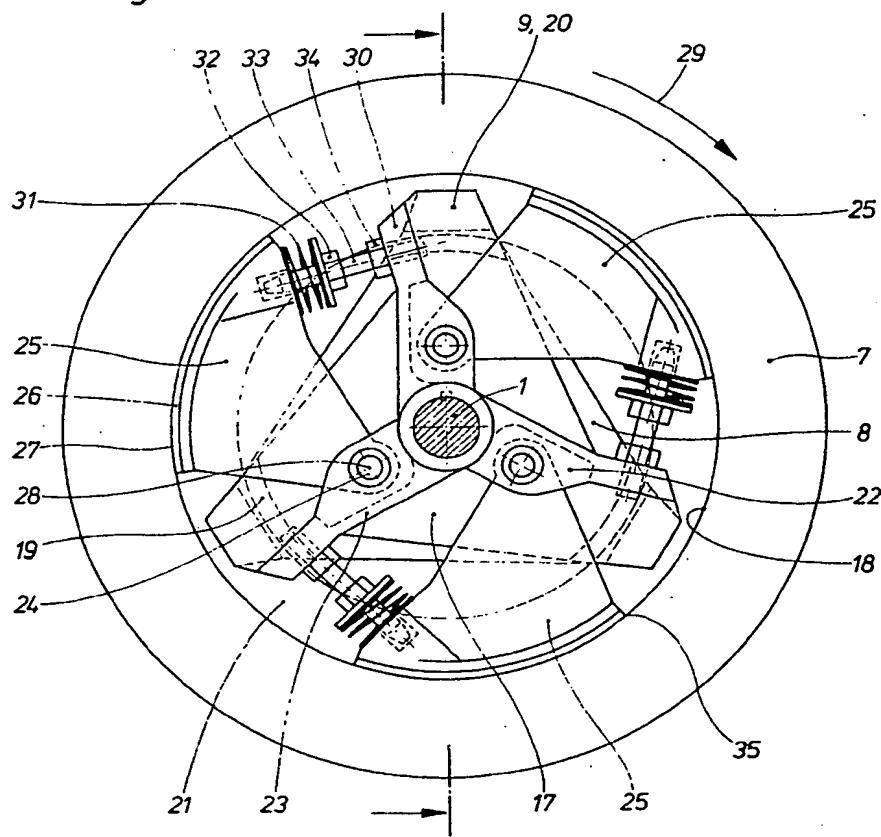
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(54) Force-limiting clutch, especially for agricultural pick-up balers

(57) A force-limiting clutch is described for establishing a frictional connection between a flywheel and a main drive shaft of an agricultural pick-up baler. Swingable clutch members (25) are mounted on a clutch supporting disc (16) so that they are able to pivot about respective axes (28) which are spaced from and parallel to that of the drive shaft, and are pressed by means of pressure

springs (31) against an inner face (18) of the driving flywheel. The swingable clutch members (25) are arranged and formed such that on the occurrence of an overload moment they pivot in the direction of rotation so that their friction surfaces (27) disengage from the inner face (18) of the flywheel. Through this arrangement, very strong disengagement forces result in a friction pair, so that the force-limiting clutch responds with only a slight overload moment even in the case of rusted-up friction facings (26) on the face rim of the clutch (18). The clutch is in series with a slip coupling (Fig. 1).

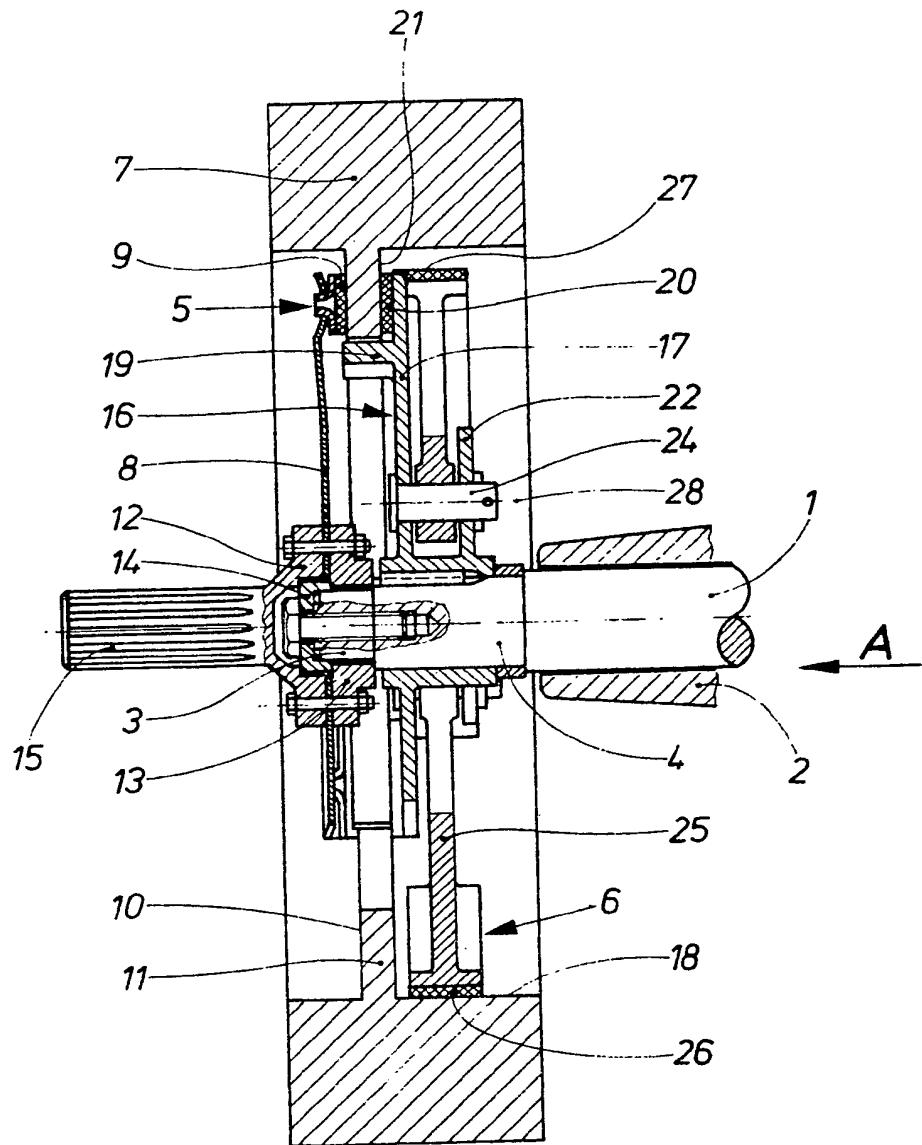
Fig. 2



GB 2 084 268 A

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

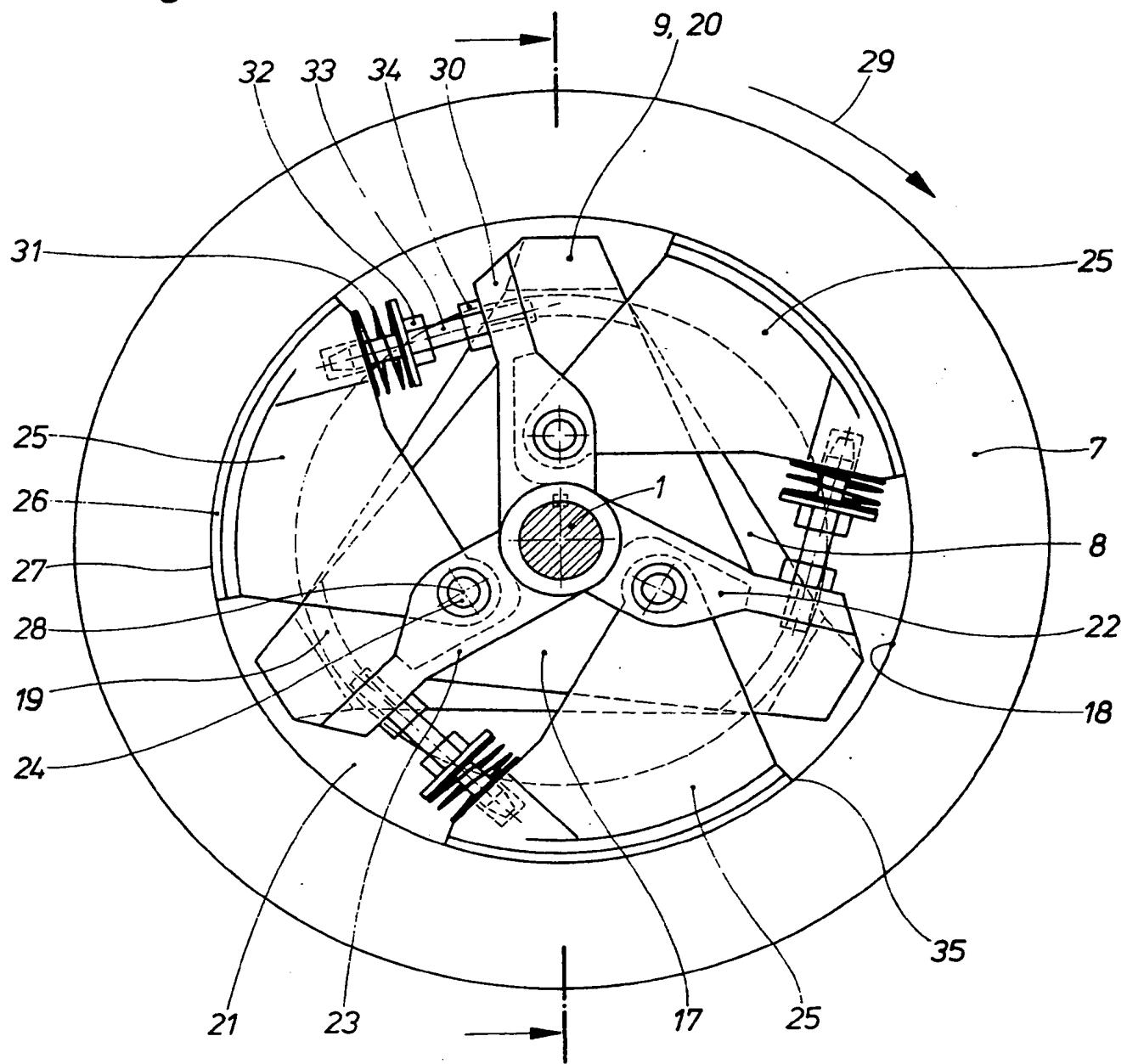
Fig.1



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2/2

Fig. 2



SPECIFICATION**Force-limiting clutch especially for agricultural pick-up balers**

This invention relates to a force-limiting clutch, 5 and is particularly concerned with, but not limited to, a force-limiting clutch for establishing a frictional connection between a flywheel and a main drive shaft of an agricultural pick-up baler.

In an agricultural pick-up baler, the shock load 10 of the press plunger on the driving gear is such that the pick-up baler must have a large flywheel mass. In previously known pick-up balers a flywheel is mounted in front of the main transmission gear and is generally driven from a 15 power take-off shaft of a tractor at a speed of 540 r.p.m. Between this flywheel and the main drive shaft, which leads to the main transmission gear, a force-limiting clutch is arranged in the form of a friction clutch. It is intended to prevent the 20 driving gear of a press plunger suddenly locked by overloading, obstruction or foreign bodies from being damaged by the flywheel mass, from which further consequential damages result.

Friction clutches on agricultural harvesters are 25 subject to a particular extent to the danger of rusting-up or sticking fast in the period when they are not in use, which can occasionally amount to 11 months of the year, and during which the machines are often left to stand in damp places.

The moment of response of rusted-up friction 30 clutches rises considerably before the connection resulting from corrosion is broken loose. In this way the safety of the baler driving gear is jeopardized.

The invention is concerned with the problem of 35 separating rusted-up clutch members of the force-limiting clutch with only a slight overload moment.

According to the present invention there is provided a force-limiting clutch, wherein a clutch-supporting disc is adapted to be mounted fast for rotation on a main drive shaft and carries swingable clutch members which are mounted for pivotal movement about respective axes which are spaced from and parallel to the axis of the drive 45 shaft, and wherein each clutch member has a friction surface adapted to engage against an inner face of the clutch, each friction surface lying in front of (relative to the intended direction of rotation of the clutch) the point of intersection 50 with said inner face of a line which extends radially from its associated pivot axis and which is normal to a tangent to said inner face.

As indicated above, the present clutch is particularly suitable for use in an agricultural pick-up baler for establishing a frictional connection 55 between a flywheel and a main drive shaft of the baler.

The present clutch is constructed to utilise the known physical behaviour of two surfaces, 60 connected for example by adhesion or soldering, which break apart at a relatively small tensile load normal to their connecting surface, whilst on loading in the direction of the connecting surface (tangential stress) they can withstand much higher

loads without breaking. Particularly, upon the introduction of normal traction at one end of the connected surfaces high tension peaks occur, which are even able to destroy a connection which in itself is very firm. It was found that rusted-up 70 clutch facings behave in a similar manner. Through the arrangement of the present clutch members and their friction facings the friction moment of the flywheel exerts a force component on the swingable clutch members, which is 75 directed inwards by the inner face of the clutch. When the permitted transmission moment is exceeded, this inwardly-directed force separates the, for instance, rusted-up friction surfaces of the swingable clutch members from the inner face of 80 the clutch. The contact-breaking force only requires a slightly increased overload moment, so that damage to the machine is avoided.

In order to enable the invention to be more readily understood, reference will now be made to 85 the accompanying drawings, which illustrate diagrammatically and by way of example an embodiment thereof, and in which:

Figure 1 is a cross-section through a force-limiting clutch, and

Figure 2 is a view in the direction of arrow A in Figure 1 with part of the shaft removed.

Referring now to the drawings, the driving gear of a pick-up baler has two clutches connected in series: a friction clutch 5 on the tractor side and a 95 force-limiting clutch 6 on the baler side, the latter also being in the form of a friction clutch. A main drive shaft 1 of a main transmission gear 2 has on its front end two stepped shaft portions 3 and 4. The friction clutch 5 is mounted on the front stepped portion 3 and the force-limiting clutch 6 is mounted on the rear stepped portion 4. A flywheel 7 is mounted between the two clutches 5 and 6 so as to provide counter friction surfaces for the two clutches.

The transmission movement of the friction clutch 5 is relatively small in order to protect the tractor drive by means of friction slip from periodic irregularities in rotational speed of the flywheel caused through the shock load of the press plunger. The clutch 5 has a triangular-shaped

spring plate 8, which at each apex carries a friction plate 9 lying in a radial plane of the clutch. The friction plates 9 rest under the tension of the spring plate 8 against a friction surface 10 of an internal flange 11 of the flywheel 7 and form a friction pair with this surface. The spring plate 8 is clamped in a double flanged hub 12, 13 which is arranged to be freely rotatable on the front stepped shaft portion 3 and is axially secured by a cap 14 screwed on the front face of the shaft portion 3. The front piece 12 of the flanged hub has a front-facing stub shaft 15 for connection with a tractor universal joint shaft.

The axial spring tension producing friction contact is reinforced to the rear by a clutch-supporting disc 16. This also supports and guides the flywheel 7 in an axial and a radial direction and is also a component of the force-limiting clutch 6.

The clutch supporting disc 16 lies within the

face of the flywheel 7 and on the opposite side of the internal flange 11 to the spring plate 8. It consists of a substantially equilateral triangular mounting plate 17, which is fixed on the second shaft portion 4 by splines. Its three apices are cut off and extend close up to the inner face 18 of the clutch. In an axial direction towards the front, each corner has an axial projection 19, which engages within the internal flange 11 of the flywheel 7 and 5 in this way supports it and guides it in a radial direction. Three axially forward-facing friction plates 20 are arranged on the outer edges of the apices of the mounting plate, and are engaged by the radial surface 21 of the internal flange 11, the 10 plates 20 forming the axial counter-support of the flywheel 7 and the support of the spring plate 8.

In operation, the tractor actuates the flywheel 7 and the main drive shaft 1 via the friction clutch 5. If the friction contact produced by the spring plate 20 on the flywheel 7 is exceeded, the friction clutch 5 slips and the friction plates 9 slide on the friction surface 10 of the flywheel 7 thereby limiting the moment of transmission between the tractor drive gear and the flywheel 7.

25 The force-limiting clutch 6 on the baler side is arranged on the clutch-supporting disc 16. The clutch-supporting disc 16 has three arms 22 on its reverse side. Each arm 22 lies behind one of the corners of the mounting plate 17, with which it is 30 connected by a cross bar 23 to form a U-section structure. A king pin 24 is mounted between the mounting plate 17 and each arm 22 with its axis parallel to that of the main drive shaft 1. The pins 24 are contained between the external faces of 35 the flywheel and at a distance from the main drive shaft 1, which, in the embodiment shown in the drawings, is approximately one third of the radius of the inner face 18.

A swingable clutch member 23 is pivotably 40 mounted on each king pin 24, each such member broadening outwards from the pin 24 in the form of a sector of a circle and having on its outer edge a friction facing 26 with a part cylindrical friction surface 27. The swingable clutch member 25, 45 however, is formed such that the radius of the friction surface 27 is the same as that of the face 18 and such that the surface 27 lies in front of (relative to the intended direction of rotation 29) the intersection with the face 18 of a radial line 50 which extends from the axis 28 of the pin 24 and which is normal to a tangent to the face 18.

The U-shaped connection between the mounting plate 17 and each arm 22 extends radially beyond the seating of the king pin 24 in 55 the form of a solid base plate 30, which serves to hold a pressure spring 31. This extends between a swingable clutch member 25 and an abutment 32, which is mounted so that it is continuously adjustable on a threaded bolt 33 which is 60 anchored in the base plate 30 of the preceding arm 22 in the direction of rotation, by a counter nut 34.

The pressure spring 31 urges its associated

swingable clutch member 25 with its friction 65 surface 27 contrary to the direction of rotation 29 of the flywheel 7 into contact with the inner face 18, whereby a friction connection between the flywheel 7 and the main drive shaft 1 is produced. Through rotation of the abutment 32 the spring 70 tension and the desired transmission moment between the flywheel 7 and the main drive shaft 1 can be adjusted.

If this transmission moment is exceeded, the swingable clutch members 25 pivot against the 75 action of the pressure springs 31 inwards in a clockwise direction (Figure 2) so as to disengage their friction surfaces 27 from the face 18 of the clutch. If the frictional force is unduly increased by the formation of rust on the face 18 of the clutch 80 and by jamming of this surface against the friction surfaces 27, and the clutch 6 does not respond when an overload moment occurs, the swingable clutch members 25 disengage from the face 18 of the clutch as a result of the rotating motion 85 described, whereby the disengagement begins on the contact edge 35 adjacent to the pressure spring 31.

CLAIMS

1. A force-limiting clutch, wherein a clutch-90 supporting disc is adapted to be mounted fast for rotation on a main drive shaft and carries swingable clutch members which are mounted for pivotal movement about respective axes which are spaced from and parallel to the axis of the drive 95 shaft, and wherein each clutch member has a friction surface adapted to engage against an inner face of the clutch, each friction surface lying in front of (relative to the intended direction of rotation of the clutch) the point of intersection 100 with said inner face of a line which extends radially from its associated pivot axis and which is normal to a tangent to said inner face.

2. A clutch as claimed in Claim 1, wherein each swingable clutch member is urged contrary to the 105 intended direction of rotation of the clutch against said inner face by means of a pressure spring which rests on an abutment of the clutch supporting disc.

3. A clutch as claimed in Claim 2, wherein the 110 abutment is formed for continuous adjustment of the spring tension.

4. A clutch as claimed in any one of Claims 1 to 3, wherein each swingable clutch member is pivotably supported on a king pin which is 115 arranged on the clutch-supporting disc with its axis parallel to that of the main drive shaft.

5. A clutch as claimed in any one of Claims 1 to 4, wherein three swingable clutch members are mounted at 120° intervals on the clutch-120 supporting disc.

6. A clutch as claimed in any one of Claims 1 to 5, wherein a further friction clutch is connected in series therewith.

7. A force-limiting clutch substantially as 125 hereinbefore described with reference to the

3

- accompanying drawings.
- 3. In, or for use in, an agricultural pick-up baler,
a force-limiting clutch as claimed in any preceding

- 5 claim for establishing a frictional connection
between a flywheel and a main drive shaft of the
baler.

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